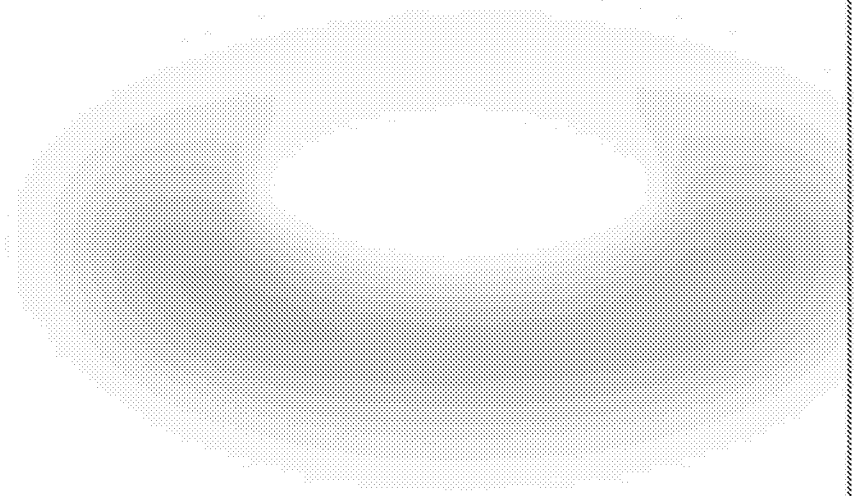




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Project: Surface Water Drainage Scoping Report (SWDS)
Prepared for: Parker Dann
Reference: 2322
Date: July 2015
Version: Final v1.1



Document Issue Record

Project: Surface Water Drainage Scoping Report

Prepared for: Parker Dann

Reference: 2322

Site Location: Land adjacent to Church Lane, Clymping, West Sussex

Proposed Development: Construction of a new area of Clymping, to include residential development, commercial facilities, allotments as well as amenity spaces.

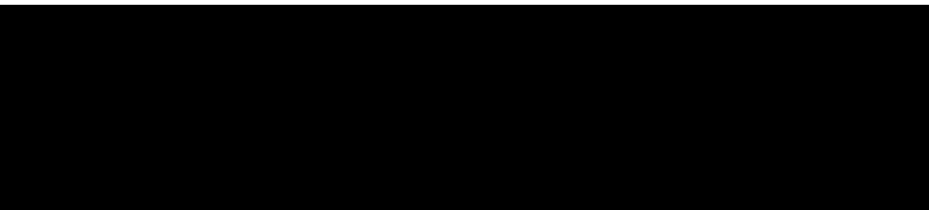
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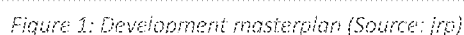


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- 1.1 This Surface Water Drainage Scoping works has been prepared by Ambiental Technical Solutions, to provide a first stage understanding of the surface water drainage requirements on the proposed development site post development.
- 1.2 It aims to provide the developer with a basic understanding of the drainage requirements for the site based on the initial development masterplan, desktop study of the ground condition of the site, existing flow pathways across the site, as well as runoff rate and storage requirements.
- 1.3 The runoff rates and storage requirements detailed within this report are based on the masterplans provided to Ambiental by Parker Dann at the time of undertaking the works. As such these runoff rates and storage requirements should be used for information only, and not part of more detailed works or a planning application.

- 1.4 It is understood that at this time the proposed development is for the construction of a new area of Clymping, to include residential development, community facilities, allotments as well as amenity spaces.
- 1.5 The number of units, for both residential and commercial uses has not been finalised at this point of the development, although it will be between 90 and 140 residential units. Nor has the final layout of public spaces and buildings been determined.
- 1.6 This study is based on the masterplan provided to Ambiental, identified as drawing number D14 4899 SK01 and dated January 2015.



2. Development Description and Site Area

- 2.1 The site is approximately 21.5ha in size and located to the south of Clymping Village in West Sussex. The site is bounded to the south by Crookthorn Lane, to the east by Church Lane, to the west by Yapton Road (B2233) and to the north by existing residential development within Clymping Village itself and Horsemere Green Lane.

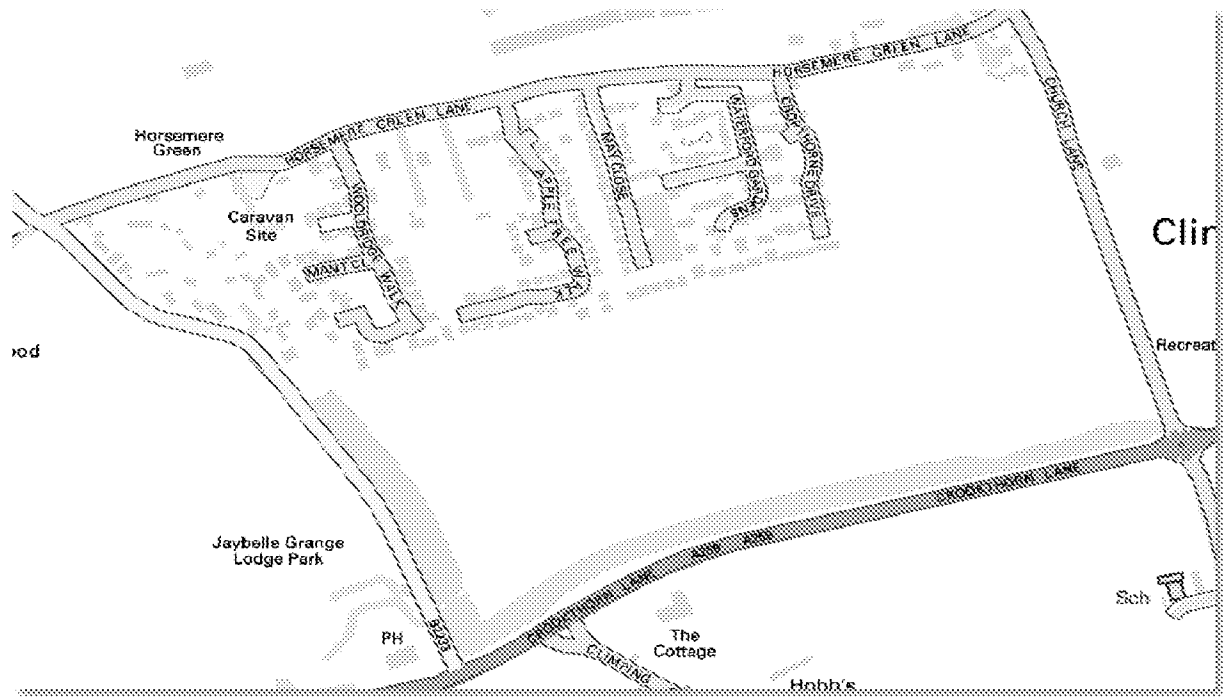


Figure 2: Wider site location (Source: OS)

- 2.2 The existing site is undeveloped land currently used for agriculture, as such the site has no impermeable surfaces and is deemed to have a 100% permeability.
- 2.3 Following development the increase in impermeable surfaces on the site will be significantly increased from 0ha to approximately 4.73ha, based on the masterplan.
- 2.4 The general topography of the site slopes from west to east, with generally higher topography to the west of the site sloping down towards the east.

Existing Drainage Infrastructure

- 2.5 Existing drainage infrastructure on site has not been addressed as part of this scoping works, however the general direction of surface water flow across the site has been determined based on 2m LiDAR topography.
- 2.6 This analysis shows that surface flow direction is generally from west to east, with flows travelling from south to north at the eastern end of the site. There are also flows potentially running from west to the east along Crookthorn Lane on the southern boundary of the site which could have a potential to affect the development's access.

- 2.7 This analysis has also shown that the general surface water flow direction from the site exits the site at the north easterly point and north westerly point.
- 2.8 The majority of the flow pathways conjoin and leave the site from the north east corner and across Church Lane. This flow pathway is towards existing development.
- 2.9 The flow pathway leaving the site at the north west corner appears to cross Yapton Road and travel towards agricultural land.

Direction of Flow



Figure 3: General surface water flow directions across the development site (Source: Ambiental, LiDAR)

Existing Ground Conditions

- 2.10 The British Geological Survey (BGS) Map indicates that the site geology is split into 2 distinct geologies.
- 2.11 The eastern half of the site has a bedrock geology of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation and Culver Chalk Formation. With a superficial geology of raised beach deposits, formed of sand and gravel.
- 2.12 The western half of the site has a bedrock geology of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation and Culver Chalk Formation. With a superficial geology of river terrace deposits, formed of sand, silt and clay.

- 2.13 The BGS Map shows no boreholes to be available across the development site, however a borehole located just north of the site at Ford Airfield, drilled in August 1981 shows that the bedrock chalk appeared to be found at a depth of 7.8m below surface.

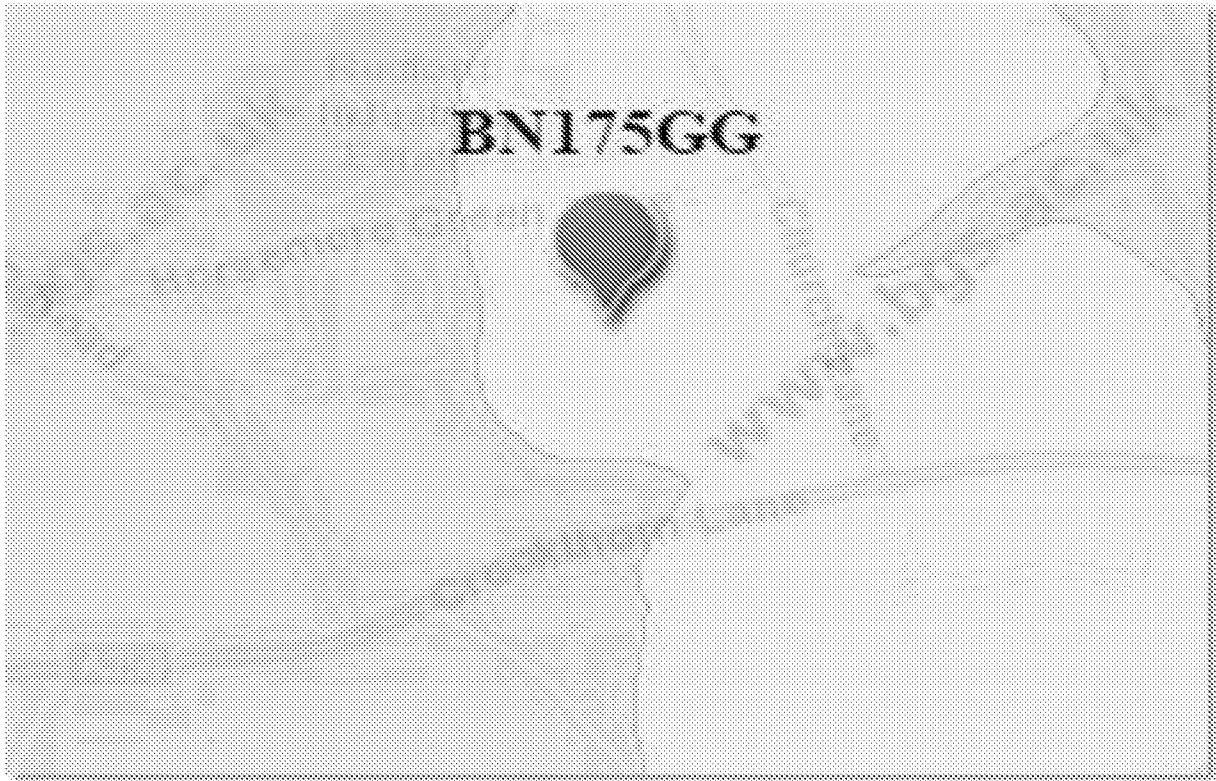


Figure 4: Geology of site; orange shows river terrace deposits, yellow shows beach deposits (Source: BGS)

- 2.14 The soil type across the site appears to be split based on the superficial geology, with the soils to the west of the site being classified by the UK Soil Observatory (UKSO) website as Sand to Loam, and the east of the site being classified as Sand to Sandy Loam.



Figure 5: Soils map of the site; green shows sand to loam and blue shows sand to sandy loam (Source: UKSO)

Groundwater

- 2.15 The site is not located in a groundwater source protection zone, however the superficial deposits across the area have been classified as 'Secondary A' aquifers and the bedrock geology has been classified as 'Principle' aquifers.
- 2.16 Secondary A aquifers are defined by the EA as 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.'
- 2.17 Principle aquifers are defined by the EA as 'layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale'.
- 2.18 As such the site's groundwater may be of local or strategic importance. Whilst the site is not shown to be in a groundwater source protection zone it is likely due to the close proximity of the bedrock to the ground level (as shown in borehole holes near to the site) that potential groundwater contamination post-development should be taken into consideration.

Nearby Watercourses and Drainage

- 2.19 The closest watercourse to the site is the River Arun, some 735m to the north-west of the site's most easterly boundary. At this location the River Arun runs in a generally north – south direction and is tidally influenced.
- 2.20 Small unnamed drains are located in close proximity to the site, however none are located on site.

3. Runoff Rates and Storage Volumes

- 3.1 The existing and proposed runoff rates, as well as the required volume of storage to mitigate the developments affect has been calculated based on impermeable areas determined using the masterplan (drawing number D14 4899 SK01).
- 3.2 The runoff rates for the site have been calculated for the 6 hour storm duration for a number of return periods, including the 1:100 year with an allowance for climate change. This has shown that the development increased runoff rate for all return periods with a storm duration of 6 hours.
- 3.3 The proposed runoff rate for the site post development for the 6 hour storm event of a 1:100 +CC return period is 400.8l/s. An increase of 150.21l/s runoff from the site post development.

Return Period	Existing Runoff Rate l/s	Proposed Runoff Rate l/s	Description of Runoff Changes	Difference in Runoff Rate for Site l/s
1	56.95	78.07	Runoff rate is increased	21.12
2	57.61	100.59	Runoff rate is increased	42.99
10	106.05	174.46	Runoff rate is increased	68.41
30	161.04	249.54	Runoff rate is increased	88.50
100	208.83	334.00	Runoff rate is increased	125.17
100 + Climate Change	250.59	400.80	Runoff rate is increased	150.21

Table 1: Runoff rates for the site during a 6 hour storm event

- 3.4 The volume of storage required to address the affect the development will have on the site has been calculated. These figures take into account the uncertainty the estimation methods have by increasing the required storage by +25% as literature suggests.

Return Period	Existing Runoff Volume mm ²	Proposed Runoff Volume mm ³	Storage Required mm ²
1	1230.18	1518.16	359.97
2	1244.32	1894.64	812.89
10	2290.69	3309.79	1273.87
50	3478.45	4770.72	1615.33
100	4510.67	6359.22	2310.69
100+ Climate Change	5412.81	7915.15	3127.92

Table 2: Volume of storage required

4. SuDS Suitability Analysis

4.1 Following analysis of the sites geology, soils and the proposed development the suitability of SuDS components has been analysed.

4.2 SuDS components work in a number of ways, the predominant being:

- Infiltration
- Conveyance into a watercourse or sewer
- Storage
- Attenuation

4.3 It is usual for a SuDS scheme to combine a number of components and a number of these processes across the site to provide a drainage strategy for the whole site.

Source Control Components

Component	Suitability for Development Type		Water Quality Treatment Potential	Amenity Potential	Suitability for Sites above Vulnerable Groundwater	Suitability for Site based on Geology and Soils
	Residential	Commercial / Industrial				
Green Roofs	Suitable	Suitable	Good	Good	Suitable	Suitable; although there concerns have been raised as to the effectiveness of green roofs once saturated
Rainwater Harvesting	Suitable	Suitable	Poor	Poor	Suitable	Suitable
Pervious Surfaces	Suitable	Suitable	Good	Poor	Suitable	Suitable; although limitations as to types of roads and traffic volumes apply

Table 3: Source Control Components

4.4 At this site source control SuDS components would be suitable given the correct design. The use of pervious surfaces for roads, driveways and pavements where suitable can significantly reduce the areas on site deemed to be impermeable and as such can help to reduce the attenuation storage required for the overall site.

Swales and Conveyancing Channel Components

Component	Suitability for Development Type		Water Quality Treatment Potential	Amenity Potential	Suitability for Sites above Vulnerable Groundwater	Suitability for Site based on Geology and Soils
	Residential	Commercial / Industrial				
Swales	Suitable	Suitable	Good	Medium to Good depending on design	Suitable with liner in place	Suitable; although liners may be required to protect potential groundwater beneath site
Channels or Rills	Suitable	Suitable	Good to Very Good depending on design	Good to Very Good depending on design	Suitable with liner in place	4.4 Suitable; although liners may be required to protect potential groundwater beneath site

Table 4: Swales and Conveyancing Channel Components

- 4.5 The site has not at this stage been shown to be above a sensitive groundwater source, however due to the geology of the site groundwater contamination is a potential concern post-development. As such it is advised that should swales or channels be used within the development appropriate liners are used.

Filtration Components

Component	Suitability for Development Type		Water Quality Treatment Potential	Amenity Potential	Suitability for Sites above Vulnerable Groundwater	Suitability for Site based on Geology and Soils
	Residential	Commercial / Industrial				
Filter Strips	Suitable	Suitable	Medium	Medium	Unsuitable	Potentially unsuitable due to groundwater vulnerability potential
Bio-retention Areas	Suitable	Suitable	Good	Good	Suitable	Suitable on areas of site without steep slopes
Filter Trench	Suitable	Suitable	Good	Poor	Suitable	4.6 Suitable; although requires high levels of regular maintenance

Table 5: Filtration Components

4.7 Filtration SuDS components appear to be largely suitable for the proposed development site, although by their nature they pose a potential risk of introducing contaminants into the groundwater beneath the site. As such appropriate levels of treatment should be undertaken before water is released through further drainage components into the ground beneath the site.

Retention and Detention Components

Component	Suitability for Development Type		Water Quality Treatment Potential	Amenity Potential	Suitability for Sites above Vulnerable Groundwater	Suitability for Site based on Geology and Soils
	Residential	Commercial / Industrial				
Detention Basin	Suitable	Suitable	Medium	Good	Suitable, with liner	Suitable
Retention Pond	Suitable	Suitable	Good	Good	Suitable, with liner	Suitable; potential H&S concerns of permanent water on site
Geocellular drainage	Suitable	Suitable	Poor	Poor	Suitable	4.8 Suitable

Table 6: Retention and Detention Components

- 4.9 Retention and detention SuDS components appear to be suitable for the proposed development site. These components are designed to store water and slow its release, either into further SuDS components or into watercourses or the sewers. Detention basins are designed to be dry for most of the time, whilst retention ponds are designed to contain some water all year round. As such the amenity potential for both of these options is high within a development such as the proposed works in Clymping.
- 4.10 The existing masterplan incorporates ponds as part of the amenity spaces, which provides potential to use these features within the drainage system on the site.

Infiltration Components

Component	Suitability for Development Type		Water Quality Treatment Potential	Amenity Potential	Suitability for Sites above Vulnerable Groundwater	Suitability for Site based on Geology and Soils
	Residential	Commercial / Industrial				
Soakaways	Suitable	Suitable	Good	Poor	Unsuitable	Potentially unsuitable due to groundwater vulnerability potential
Infiltration Trench	Suitable	Suitable	Good	Poor	Unsuitable	Potentially unsuitable due to groundwater vulnerability potential.
Infiltration Basin	Suitable	Suitable	Good	Good	Unsuitable	Potentially unsuitable due to groundwater vulnerability potential
Rain Gardens	Suitable	Suitable	Medium	Good	Unsuitable	4.11 Potentially unsuitable due to groundwater vulnerability potential

Table 7: Infiltration Components

- 4.12 Infiltration post-development has the potential to be unsuitable due to the potential groundwater contamination concerns at the sites location. However should the appropriate treatment train be followed the use of infiltration components is likely to be suitable.

Wetlands

Component	Suitability for Development Type		Water Quality Treatment Potential	Amenity Potential	Suitability for Sites above Vulnerable Groundwater	Suitability for Site based on Geology and Soils
	Residential	Commercial / Industrial				
Wetlands	Suitable	Suitable	Good	Good	Suitable, with liner	4.13 Suitable

Table 8: Wetlands

4.14 Wetlands are likely to be suitable to use within the development, and provide both good water quality treatment potential but can be used to increase local amenity. The combination of ponds and wetlands can provide a SuDS component train whilst increasing amenity within the development.

4.15 As the proposed masterplan includes ponds, wetlands could be used to provide a further ecosystem, increase biodiversity, improve amenity whilst providing water treatment as part of the drainage scheme.

Other Structures

Component	Suitability for Development Type		Water Quality Treatment Potential	Amenity Potential	Suitability for Sites above Vulnerable Groundwater	Suitability for Site based on Geology and Soils
	Residential	Commercial / Industrial				
Inlet, Outlet and Control structures	Suitable	Suitable	Medium, depending on design	Poor	Suitable	Suitable
4.16 Vortex Flow Controls	Suitable	Suitable	Low	Low	Suitable	4.17 Suitable

Table 9: Other Structures

4.18 These other components are often used between SuDS components, as well as at any end points of the drainage where water is released from the site. These components can control flow rates, provide sediment filtration, as well as petrochemical control.

5. Conclusions

- 5.1 The existing site is greenfield and currently used for agriculture. Post development there will be an increase of impermeable surfaces on the site, based on calculations derived from the masterplan the proposed development's impermeable footprint will be approximately 4.73ha.
- 5.2 Based on the 1:100 year with an allowance for climate change 6 hour storm event the proposed development will be required to provide 3127.92m³ of storage to mitigate against the post-development run off rate of 400.80l/s.
- 5.3 The site is located on largely permeable superficial and bedrock geology and as such infiltration components are suitable for the site, given that appropriate treatment can be provided to address the potential groundwater contamination concerns.
- 5.4 Analysis of the masterplan and the general surface water flow directions across the existing site using 2m LiDAR topography has shown that at present ponds have been located on the highest elevations of the site. As such failure of these ponds could result in waters flowing across the site in the direction shown by the flow direction analysis should the sites topography remain the same post-development.

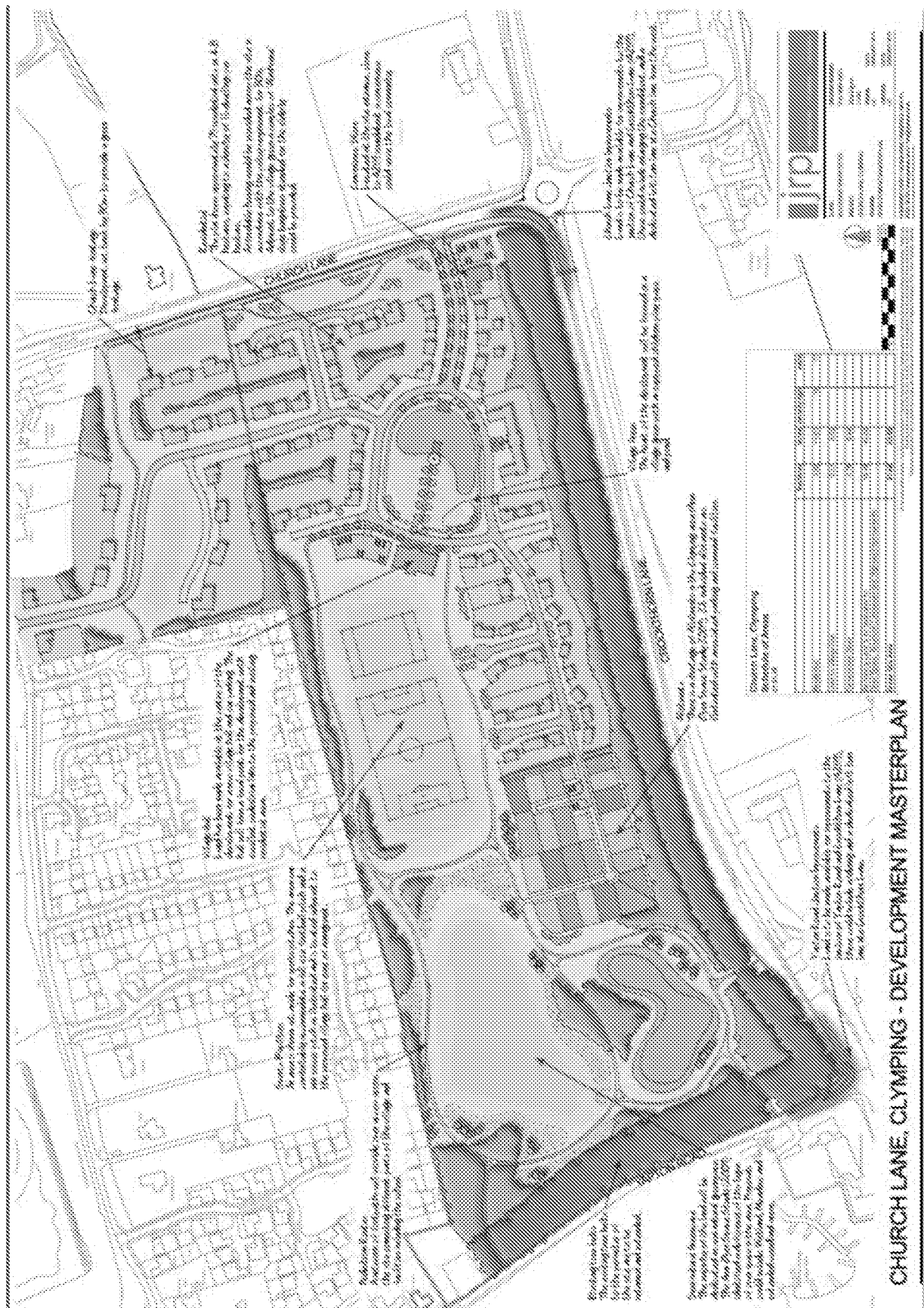
The findings and recommendations of this report are for the use of the client who commissioned the assessment, and no responsibility or liability can be accepted for the use of the report or its findings by any other person or for any other purpose.

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August 2015

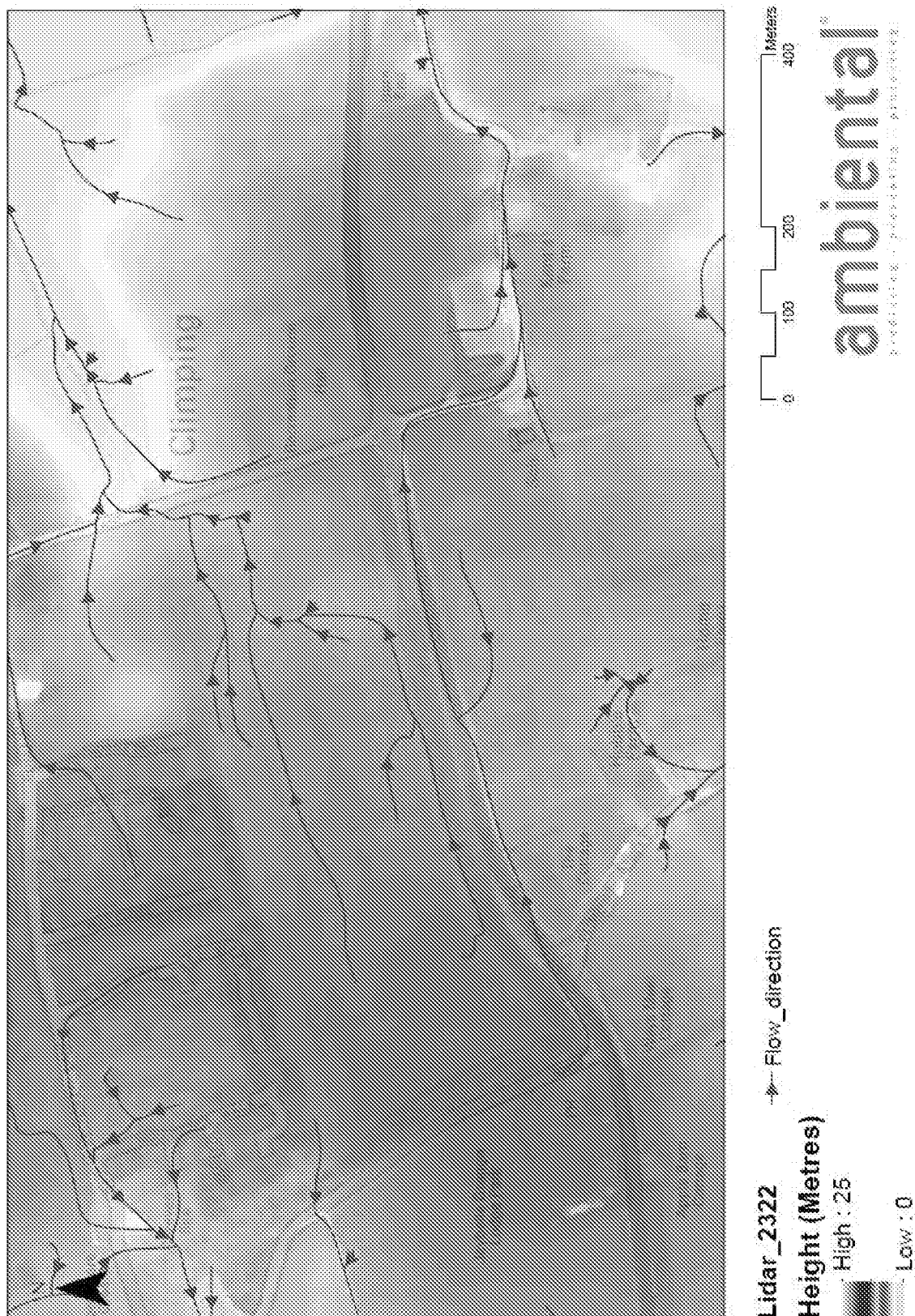
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Appendix A; Figure 1 - Masterplan (Source: jrp)

Direction of Flow



Appendix A; Figure 2 - Direction of surface water (Source: Ambiental)

Appendix 2 – Information

Surface Water Runoff Calculation Method

Rainfall data has been extracted from the FEH CD-ROM for the several storm duration events for a number of return periods, including 1:1.01 year, 1:10 year and 1:100 year storm events. These return periods are industry standard, however it is important to be aware that return periods less than 1:2 years are not considered reliable and should not be used in detailed design calculations.

The 1:100 year with an allowance for climate change has been based on a 30% increase to the 1:100 year rainfall intensity and not the rainfall depth. This is to provide the most conservative runoff rates for the site possible.

Greenfield runoff rates have been calculated using The Institute of Hydrology Report 124 Marshall and Bayliss, 1994 method, as recommended in the *CIRIA 697 'The SUDS Manual'*. In keeping with standard practice, the calculations are based on calculating the Greenfield runoff rates for a 50 Ha site and then factored to account for the actual site size.

Impermeable runoff rates have been calculated using the Modified Rational Method for the impermeable surfaces on site only.

Throughout the calculations a weighted co-efficient has been used, allowing different materials of surface covering on site to be taken into account.

These runoff rates have then been combined to provide the most accurate runoff rate possible for both the existing and proposed site.